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SOLAR MAGNETIC FIELD: EXISTENCE OF A PREFERRED LONGITUDE

Eleven year variations are a fundamental aspect of the sun's magnetic field. An important question is whether or not there are aspects of the field that persist in spite of the obvious solar cycle variations. One way such an invariant feature could be manifested is the existence of a "preferred" longitude at which a structure or a series of events are independent of the solar cycle or its phases. During cycle 20, a preferred longitude was, in fact, identified from which fast solar wind originated (Gosling et al., JGR, p.2371, 1977). Motivated by these considerations, we investigated the behavior of the solar wind speed and the radial component of the heliospheric magnetic field over the prior and subsequent cycles using all available spacecraft measurements obtained inside 3 AU. It has been found that a preferred longitude corresponding to a source of fast wind and the $m=1$ component of the solar magnetic field has persisted over the last 35 years (Neugebauer et al., 1999). The solar rotation period associated with this persistent feature is 27.01 to 27.06 days. Magnetic activity on sun-like stars evident in calcium II H and K emissions also provides evidence of preferred longitudes that persist over several activity cycles in some stars (Vaughan, Science, p.793, 1984). These combined observations indicate that this aspect of the sun's magnetic field is not anomalous but may be of fundamental importance in understanding solar-stellar magnetic fields and their generation.

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